INSTRUCTION BOOK

for

TYPE REK-140

RANGE EXTENSION

MODIFICATION KIT

NEMS CLARKE CO.

919 JESUP BLAIR DRIVE • SILVER SPRING, MARYLAND

A DIVISION OF Vitro CORPORATION OF AMERICA

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CCE-5586-052059-CC

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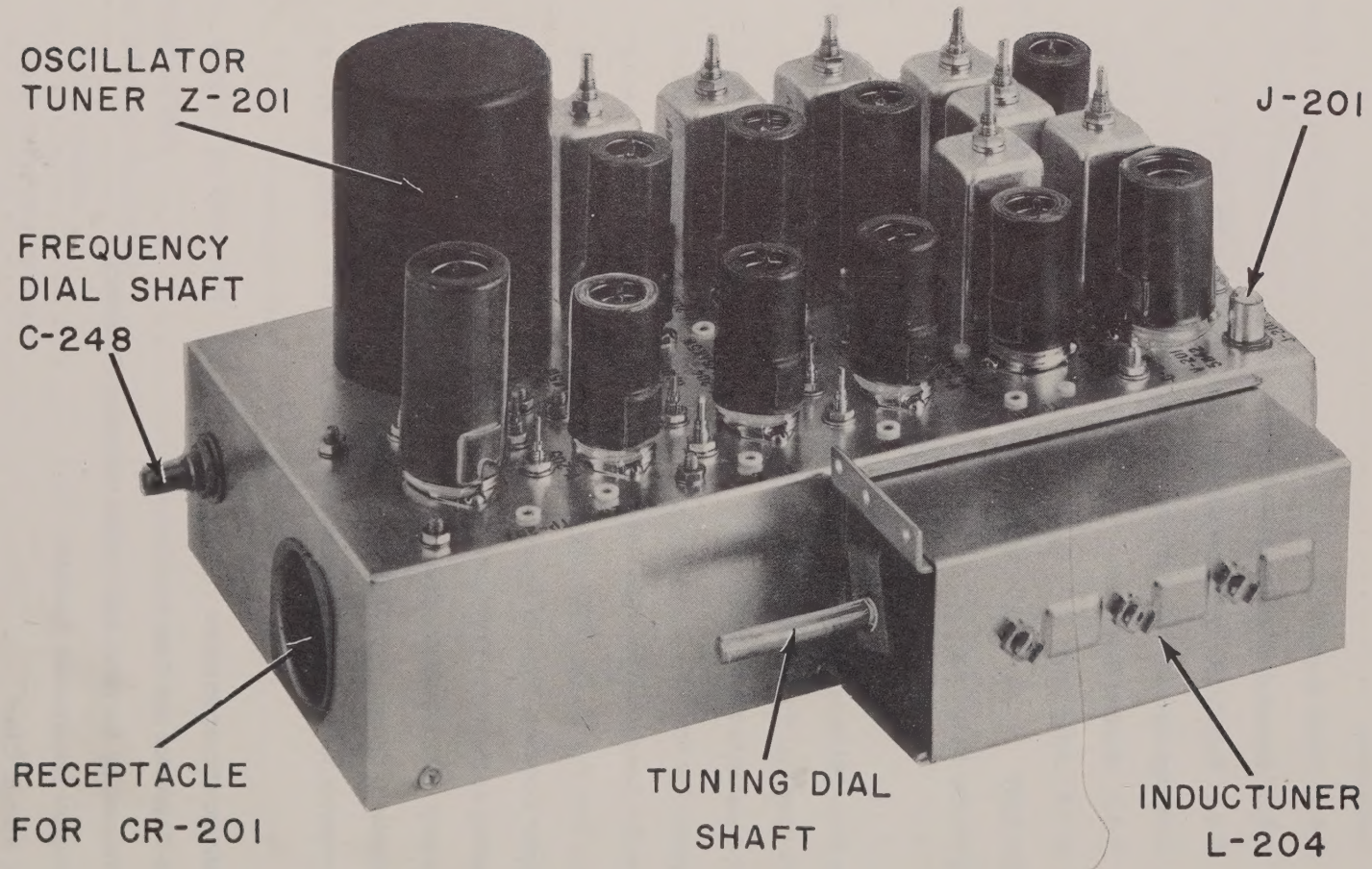


Figure 1-1. Type REK-140 Range Extension Kit RF Chassis, Overall View

SECTION 1

GENERAL DESCRIPTION

1-1. GENERAL.

The Type REK-140 Range Extension Modification Kit is a fully aligned, ready to operate, RF Sub-Chassis Assembly tunable from 215 to 260 MC, completely interchangeable with the existing RF Sub-Chassis assembly of telemetry receivers having a limited range of 215 to 245 MC, or 225 to 260 MC. The kit is furnished complete with tuning dial calibrated from 215 to 260 MC, the necessary mounting accessories, and installation instructions.

1-2. PURPOSE.

The Modification Kit is intended to replace the RF Chassis of Models 1400, 1400-A, 1401, 1401-A, or 1401-B, 1411 and 1411-A, Nems-Clarke Telemetry Receivers to extend the limit of the tuning range and thus afford a total extended operating tuning range of 215 to 260 MC.

1-3. COMPONENTS.

The kit consists of the following parts, ready to be installed into any of the above-mentioned receivers, after removing the existing RF Chassis:

a. RF Chassis (215 to 260 MC range) fully assembled and electronically aligned.

b. Tuning dial for the inductuner, calibrated 215 to 260 MC.

   1. With VIZ type Knob for Models 1400, 1401, 1401-A and 1411. (assembled) Figure 6-1 A.

   2. With Raytheon type knob for Models 1400-A, 1401-B and 1411-A, Figure 6-1 C & D.

c. Adaptor for Mounting "VIZ" type knob FREQ. dial, Figure 6-1 B.

d. Mounting Accessories and Installation Instructions.

1-4. PHYSICAL DESCRIPTION.

For complete physical description and installation instructions, see SECTION VI, INSTALLATION, in this manual.

TABLE 1-1. ELECTRICAL CHARACTERISTICS, TYPE REK-140 RANGE EXTENSION KIT

Frequency Range	215-260 Megacycles - determined by plug-in crystals, or variable frequency tuning unit.
Input Impedance	50 ohms nominal.
Noise Figure	Less than 8 db.
First Local Oscillator	Crystal* controlled, or Variable Frequency Tuning Unit** controlled.
Second Local Oscillator	Tunable over a frequency range about the second IF frequency of ±150 KC's.
IF Frequency	30 MC

TABLE 1-2. SEMI-CONDUCTOR AND TUBE COMPLEMENT, TYPE REK-140 RANGE EXTENSION KIT

Symbol	Tube Type	Equivalent Standard Type	Function
CR-201	CO-400* or VF-1400**		Frequency Oscillator Control* Frequency Oscillator Control**
V-201	5842/417A	5842/417A	Amplifier, RF
V-202	5654/6AK5W	6AK5	First Mixer
V-203	5654/6AK5W	6AK5	Amplifier, Buffer
V-204	5654/6AK5W	6AK5	Doubler
V-205	5654/6AK5W	6AK5	Amplifier
V-206	6BZ7	6BZ7	Tripler, Oscillator
V-207	6AU6WA	6AU6	Second Oscillator
V-208	6AU6WA	6AU6	Amplifier, Buffer
V-209	6AU6WA	6AU6	Second Mixer
V-210	5749/6BA6W	6BA6	Amplifier, 30 MC IF (100 KC)

* Accessory fixed-frequency Crystal-and-Oven Assembly, NEMS-CLARKE Type CO-400.

** Accessory variable frequency tuning unit variable over the entire frequency range of the receiver, NEMS-CLARKE Type VF-1400.

SECTION II

THEORY OF OPERATION

2-1. GENERAL.

In order to achieve increased range, considerable attention has been given in the design of this unit, to the reduction of receiver noise figure. The amplifier of the RF stage which determines the noise figure, uses a Western Electric 5842/417A tube in a grounded grid amplifier to obtain noise figures less than 8 db. To achieve the desired stability of $\pm$0.002% of the received frequency, the first local oscillator is controlled by a quartz-crystal oscillator circuit, Crystal-and-Oven Assembly, plugged into the octal receptacle in the front panel. Stability is somewhat lower when a Variable Frequency Tuning Unit* is used.

2-2. STAGE-BY-STAGE THEORY.

Please refer to the block diagram, Figure 2-1 which will be found helpful in tracing the Signal through the unit.

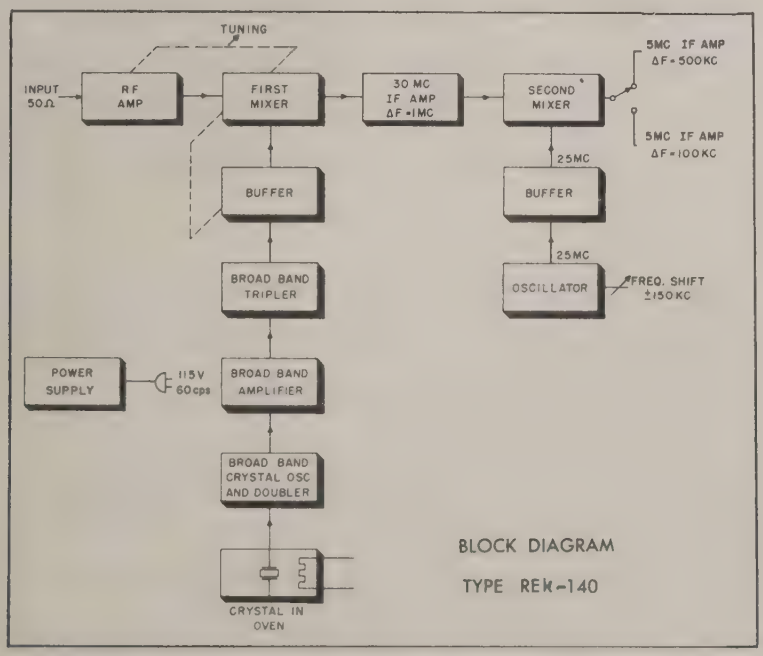


Figure 2-1. Block Diagram, Type REK-140 Range Extension RF

2-2.1. RF Amplifier. The input of the RF Amplifier is designed to work from a 50-ohm source, and the receiver noise figure, when thus operated is less than 8 db. A double-tuned bandpass circuit is used

* Accessory tuning unit continuously variable over the entire range of the receiver (215 to 260 MC).

to couple the plate of the RF amplifier to the grid of the mixer. This circuit is inductively tuned using two elements of a three-gang Mallory UHF Inductuner. Excellent tracking is maintained over the band by the use of trimming and padding coils. Primary and secondary circuits are coupled together with a capacitive "T" network with an adjustable shunt arm. To achieve low noise performance, the Western Electric 5842/417A tube, V-201, is used in a grounded grid circuit.

2-2.2. First Mixer. A triode-connected 6AK5 tube is used as a mixer in the interest of low overall noise figure. Neutralization of this circuit is obtained by using a balanced plate circuit and the neutralizing capacitor, C-215. This oscillator signal is coupled via the capacitor, C-216, to the grid of the mixer. Oscillator injection is sufficient to cause a DC voltage of approximately 3 volts at the grid.

2-2.3. First Local Oscillator. The first local oscillator of each receiver is basically a crystal oscillator followed by a multiplier chain which multiplies the crystal frequency by a factor of 6. The crystal oscillator circuit operates the crystal at series resonance.

2-2.3.1. Crystal Control. Third overtone crystals between 40.8333 to 48.3333 megacycles are used for optimum frequency stability and tuning precision, and are available over the entire tuning range in any specified frequency (See Table 3-1). The crystal is mounted in a constant temperature oven to obtain the frequency stability of plus or minus 0.001% over an operating ambient temperature range between 0^{o} and 120^{o} F.

2-2.3.2. Variable Frequency Control. The REK-140 includes a 10-watt resistor, R-255, which permits the use of a single variable frequency tuning unit accessory Nems-Clarke Type VF-1400 variable over the entire range of 215-260 MC, in lieu of crystal-and-oven assemblies.

2-2.3.3. Oscillator and Multiplier Chain. The main feature of the oscillator and multiplier chain is that broad-band circuits are used up to the final doubler plate. This avoids the difficulties that would be encountered if all the tuned circuits were ganged together and had to be tracked over the band. To accomplish broad-band operation, tubes that are capable of large gain bandwidth product are used. Tripler action is obtained in the plate of the cathode follower section of the Butler oscillator, V-206. The voltage is then amplified by V-205 to obtain sufficient drive to operate the doubler, V-204. After doubling, the output voltage is amplified by the buffer stage, V-203. This stage has a plate tank circuit ganged with the

RF tuning. The third section of the UHF inductuner is used for this purpose. With the exception of the buffer plate circuit, all other interstage networks are double-tuned circuits. Two advantages are gained from their use; more gain, and increased rejection to submultiples of the local oscillator frequency.

2-2.4. Thirty Megacycle IF Amplifier. The thirty megacycle output of the first mixer is amplified by V-210. A 6BA6 semi-remote cutoff tube is used because this stage is the first to which AGC is applied. A double-tuned interstage network with a bandwidth of approximately one megacycle is used to couple the 30-megacycle amplifier to the second mixer.

2-2.5. Second Mixer. The 30-megacycle output of the first IF assembly is combined with a 25-megacycle signal from the second local oscillator to produce a 5-megacycle frequency difference for use in the second IF amplifier. Since the gain prior to this stage is sufficient to remove it from noise figure considerations, a pentode mixer, V-209, is used. A double-tuned circuit is used in the plate of the second mixer to couple the 5-megacycle output to either the 100 KC or 500 KC wide second amplifier. Since different double-tuned circuits are required, a common primary is provided that works with either of the 5-megacycle amplifiers.

2-2.6. Second Local Oscillator. The second local oscillator is comprised of a 6AU6 electron-coupled oscillator, V-207, operating at 25 megacycles, and a buffer stage. Every effort has been made to realize the utmost in frequency stability in the oscillator circuit. The coil is of metalized glass construction which gives a small, stable, positive temperature coefficient of inductance. Temperature compensation by the use of negative temperature coefficient capacitors results in an oscillator that is extremely stable with temperature. In most cases the transmitter and receiver will not be operating at exactly the same frequency. It is therefore necessary that a small variation in frequency be obtined in this oscillator to permit the receiver to be tuned to the transmitter. A vernier frequency range of $\pm$150 kilocycles is provided for this purpose.

TABLE 3-1

CORRESPONDING RECEIVER AND CRYSTAL OPERATING FREQUENCIES

IN ONE-HALF MEGACYCLE INCREMENTS*

Operating Frequency (MC)	Crystal Frequency (MC)	Operating Frequency (MC)	Crystal Frequency (MC)	Operating Frequency (MC)	Crystal Frequency (MC)
215.0	40.8333	230.5	43.4166	246.0	46.0000
215.5	40.9166	231.0	43.5000	246.5	46.0833
216.0	41.0000	231.5	43.5833	247.0	46.1666
216.5	41.0833	232.0	43.6666	247.5	46.2500
217.0	41.1666	232.5	43.7500	248.0	46.3333
217.5	41.2500	233.0	43.8333	248.5	46.4166
218.0	41.3333	233.5	43.9166	249.0	46.5000
218.5	41.4166	234.0	44.0000	249.5	46.5833
219.0	41.5000	234.5	44.0833	250.0	46.6666
219.5	41.5833	235.0	44.1666	250.5	46.7500
220.0	41.6666	235.5	44.2500	251.0	46.8333
220.5	41.7500	236.0	44.3333	251.5	46.9166
221.0	41.8333	236.5	44.4166	252.0	47.0000
221.5	41.9166	237.0	44.5000	252.5	47.0833
222.0	42.0000	237.5	44.5833	253.0	47.1666
222.5	42.0833	238.0	44.6666	253.5	47.2500
223.0	42.1666	238.5	44.7500	254.0	47.3333
223.5	42.2500	239.0	44.8333	254.5	47.4166
224.0	42.3333	239.5	44.9166	255.0	47.5000
224.5	42.4166	240.0	45.0000	255.5	47.5833
225.0	42.5000	240.5	45.0833	256.0	47.6666
225.5	42.5833	241.0	45.1666	256.5	47.7500
226.0	42.6666	241.5	45.2500	257.0	47.8333
226.5	42.7500	242.0	45.3333	257.5	47.9166
227.0	42.8333	242.5	45.4166	258.0	48.0000
227.5	42.9166	243.0	45.5000	258.5	48.0833
228.0	43.0000	243.5	45.5833	259.0	48.1666
228.5	43.0833	244.0	45.6666	259.5	48.2500
229.0	43.1666	244.5	45.7500	260.0	48.3333
229.5	43.2500	245.0	45.8333		
230.0	43.3333	245.5	45.9166		

* Other crystal frequencies can be determined by using the following formula:

$$F_c = \frac{F_r + 30}{6}$$

F_c = Crystal Frequency in Megacycles
F_r = Receiver Operating Frequency in Megacycles

NOTE: All other decimal frequencies are available on order for your special requirements

Type CO-400 Crystal and Oven Assembly
WHEN ORDERING SPECIFY EXACT CRYSTAL FREQUENCY DESIRED

SECTION III

OPERATION

3-1. PRELIMINARY.

After installation of the REK-140 Modification Unit is completed, as outlined in Section VI, connect the receiver to the antenna at input jack, J-103, and to a source of 115V, 60C, ac current.

3-1.1. Selecting Operating Frequency. Plug in a crystal-and-oven assembly CR-201*, for the desired signal frequency into the receptacle on the front panel. Table 3-1 gives the proper crystal frequency to use for operating frequencies, in half-megacycle increments between 215.0 and 260.0 megacycles. Crystal-and-oven assemblies for other frequencies can be determined by using the following formula:

$$F_c = \frac{F_r + 30}{6}$$

F_c = Crystal Frequency in Megacycles

F_r = Receiver Operating Frequency in Megacycles

3-1.2. Use of Variable Frequency Tuning Unit.** When using a Variable Frequency Tuning Unit instead of crystal-and-oven assemblies, plug the unit into the socket and turn the dial of the tuning unit to the desired receiver operating frequency.

3-2. CONTROL SETTINGS.

Set the TUNING dial (calibrated 215 to 260 MC) to the proper operating frequency. The FREQ dial (calibrated +150 -0 -150 Kilocycles) should be set to zero. Advance the AUDIO GAIN control clockwise. Set the IF SELECTOR switch to the "100 KC" or the "500 KC" position, and the deviation meter range switch, DEV KC, to 150 KC.

3-3. OPERATING PROCEDURES.

Place the POWER switch in the "ON" position.

3-3.1. Crystal Frequency Control. Both pilot lamps on the front panel should light when a crystal-and-oven assembly is used as a frequency selector. The lamp nearest the off-on switch indicates the power-on condition; the other indicates that the crystal oven is heating. In five or six minutes the "oven-on"

* Accessory fixed-frequency crystal-and-oven assembly, NEMS-CLARKE Type CO-400.

** Accessory tuning unit variable over the entire frequency range of the receiver, NEMS-CLARKE Type VF-1400

light will go off, indicating the oven has reached operating temperature. At this time, the receiver is ready for operation. While the receiver is in operation, the "OVEN-ON" light will flicker on and off indicating the action of the oven thermostat.

3-3.2. Variable Tuning Unit Control. If a variable frequency tuning unit is used, only the POWER-ON pilot will light, and any frequency may be instantly selected.

3-4. DETERMINING NORMAL OPERATING CONDITIONS.

3-4.1. Tuning. When there is no signal at the operating frequency, the only output of the receiver will be noise that can be heard as a hiss in the speaker. In the presence of a carrier, this noise will disappear, and, if the carrier is frequency modulated by an audible signal, audio output will be obtained. The condition of tuning is shown on the TUNING METER. The Tuning Meter pointer should be brought to zero by turning the FREQ dial. The dial will then indicate, in kilocycles, the frequency difference of the transmitter and the receiver. The tuning meter has been designed to provide proper tuning of the receiver on FM/FM or PWM/FM telemetering signals. In the case of PWM/FM signals, the tuning meter's characteristics are such that the meter reads zero when the peak-to-peak frequency excursions of the transmitter are centered in the IF pass band of the receiver. This is important in PWM/FM reception where the 100 kilocycle wide IF is used, because often, the transmitter will have peak-to-peak frequency deviations as large as 100 kilocycles. Without such a circuit, serious distortion would result.

3-4.2. Signal Level. The SIGNAL LEVEL meter will indicate the approximate signal level in microvolts. This meter can be peaked using the TUNING control; however, it is generally recommended that the dial be set to the specified frequency as this properly centers the RF bandwidth around the operating frequency.

3-4.3. Deviation. If the carrier is frequency modulated, a reading will be obtained on the DEVIATION METER. Full-Scale ranges of 25, 75, and 150 kilocycles are provided so that the deviation of an individual subcarrier in an FM/FM telemeter can be set up. The deviation meter has a frequency response that permits accurate peak-frequency deviation measurements to be made up to 80 kilocycles.

CAUTION
The deviation meter will not accurately read the peak deviation of a number of simultaneous subcarriers such as are used in the RDB FM/FM telemetering system.

3-4.4. Signal Strength. A DC voltage proportional to the intensity of the received signal is brought out to the BNC jack on the rear apron of the receiver. This output is intended to operate a signal-strength recorder with an input resistance of 0.5 megohms or higher. (If a lower resistance load is used, it will be necessary to recalibrate the signal strength meter, OUTPUT meter of the receiver. In no case should the load be less than 0.2 megohms). The output voltage at the signal strength output jack, J-107, is approximately minus five volts for a signal input of 100 microvolts, and is so indicated on the OUTPUT meter.

TABLE 4-1. PREVENTIVE MAINTENANCE SCHEDULE

DAILY

1. Clean exterior surfaces of the equipment.
2. Check operation of pilot lights and blower motor.
3. Check electron tubes by noting whether they light up and heat up properly.
4. Check fuse for signs of overheating.

CAUTION: Turn off all power to the equipment and discharge the high-voltage supply of the receiver before performing the following operations.

WEEKLY

1. Clean the rear and sides of the receiver, with cloth or brush.
2. Clean the underside and wiring of the chassis by blowing with air hose.
3. Inspect power and filament transformers for excessive heating.

MONTHLY

1. Check resistors and capacitors for blistering, discoloration, and other evidences of overheating.
2. Check wires for cracked, and/or frayed insulation, or loose connections.
3. Tighten screws and nuts, if necessary.
4. Check finish for scratches, bare spots and corrosion. Clean and retouch if necessary.
5. Check all tube voltages against the tube voltage charts. Replace tubes if necessary, and retune circuits involved.

SECTION IV

RANGE MAINTENANCE

4-1. PREVENTIVE MAINTENANCE.

No special tools or materials are supplied or required for preventive maintenance of the Type REK-140 Range Extension Kit after installation other than to maintain the unit dust-free, and to observe the condition of the components and connections, as follows:

(1) Use a clean, dry, lint-free cloth, or dry brush, for cleaning the exposed surfaces of the chassis.

(2) If necessary, moisten the cloth or brush with a dry-cleaning solvent, then wipe the parts dry with a dry, lint-free cloth.

(3) If available, dry, compressed air, at a line pressure not to exceed 60 p.s.i. may be used to remove dust from inaccessible places. Avoid mechanical damage due to air blast when using compressed air to clean the underside of the chassis.

(4) Clean jacks and other electrical contacts with a cloth moistened with methyl chloroform, or alcohol, and wipe dry with a dry cloth.

(5) Look for loose connections or solder joints, broken or otherwise defective components, such as discoloration of resistors and capacitors due to overheating, etc., and report your findings so that corrective measures can be taken.

(6) Establish a preventive maintenance routine schedule as suggested in Table 4-1.

4-2. TROUBLE SHOOTING.

4-2.1. Checking for Normal Operation. Operation of the first mixer, 30 MC IF amplifier, second mixer, and second oscillator can be determined by connecting a 30-megacycle signal at TP-203. A fairly large signal is required because the mixer grid is being fed through a capacitive divider consisting of the stray capacity of R-203 and C-209. With a signal of 10,000 micro-volts, the tuning meter will function normally, and a reading on the signal strength meter will be obtained if this portion of the unit is operative.

4-2.2. RF Amplifier and First Oscillator. These circuits can be checked by plugging in a crystal and connecting a signal source of the proper frequency to the antenna input.

4-2.3. Localization of Trouble. In the course of these tests, the defective section of the unit should become evident through failure to perform normally. The cause can then be determined by thorough check of the circuits involved against the tube voltage chart, Table 4-2. Tubes should always be considered as possible trouble sources and immediate replacements should be made when so indicated. Often a simple visual inspection will reveal other component failures.

TABLE 4-2. TUBE VOLTAGE CHART, Type REK-140 RANGE EXTENSION RF

Symbol Number	Tube Type	Pin No.								
		1	2	3	4	5	6	7	8	9
V-201	5842/417A	103	Gnd.	Gnd.	Gnd.	Gnd.	1.1	Gnd.	Gnd.	6.35AC
V-202	5654/6AK5W	*(1) -2.3	Gnd.	6.35 AC	Gnd.	60	60	Gnd.		
V-203	5654/6AK5W	*(2) -2.35	Gnd.	6.35 AC	Gnd.	113	105	Gnd.		
V-204	5654/6AK5W	*(3) -7.5	Gnd.	6.35 AC	Gnd.	131	90	Gnd.		
V-205	5654/6AK5W	*(4) -.73	Gnd.	6.35 AC	Gnd.	127	85	Gnd.		
V-206	6BZ7	135	Gnd.	2.3	Gnd.	6.35 AC	123	*(5) -1.22	6.0	Gnd.
V-207	6AU6WA	-1.5	Gnd.	6.35 AC	Gnd.	141	122	Do Not Meas.		
V-208	6AU6WA	*(6) -.12	Gnd.	6.35 AC	Gnd.	143	89	Gnd.		
V-209	6AU6WA	*(7) -1.7	Gnd.	6.35 AC	Gnd.	146	110	Gnd.		
V-210	5949/6BA6W	-0.2	Gnd.	6.35 AC	Gnd.	146	40	-.48		

NOTES:
Line Voltage: 115V, AC, 60C.
Receiver operating at 228.5 MC;
No signal input; audio gain minimum

*(1) Measured at TP-203
(2) Measured at TP-204
(3) Measured at TP-205
(4) Measured at TP-206
*(5) Measured at TP-207
(6) Measured at TP-208
(7) Measured at TP-209

SECTION V

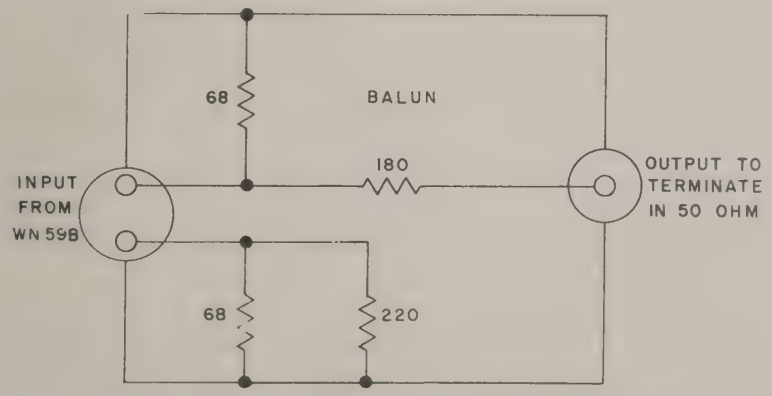
BASE MAINTENANCE

5-1. ALIGNMENT.

Normally the REK-140 Range Extension Kit will maintain good alignment for long periods of time. Changing a tube will require only minor tuning, so that complete realignment is unnecessary. In case the user wishes to check or realign the receiver, the following equipment is required:

TABLE 5-1. TEST EQUIPMENT REQUIRED

Sweep Generator.	RCA No. WR59B modified for continuous coverage from 0-260 MC, or Transitron No. SG-132.
Signal Generator	Measurements Corp. No. 65-B, or equivalent; 5 megacycles, and 30 megacycles must be set against a crystal oscillator for use as a 5 MC or 30 MC marker.
Oscilloscope	Dumont No. 304-H, or equivalent.
Frequency Meter	Signal Corps No. BC-221-Q. Use tenth harmonic or internal oscillator as a 25 MC standard.
Voltohmyst.	RCA, or equivalent.
Signal Generator	Hewlett-Packard No. 608-D, or equivalent.
Signal Generator	Boonton 202D, or equivalent.
BALUN	Balance to Unbalance Converter (300 to 50 ohms) assembled in accordance with schematic diagram.
Amplifier	30 MC, Nems-Clarke Type 4227.
Cable	Length of RG-55/U terminated in a 50 ohm resistor.



5-2. ALIGNMENT PROCEDURE.

Please refer to Figures 5-3, 5-4, 5-5, the Schematic Diagram, Figure 8-1, and the step by step alignment procedure for the Type REK-140 Range Extension Kit which follows, and also the alignment

procedure outlined in the instructions for the receiver modified.

5-2.1. Preliminary Preparation. Follow the procedure outlined in the instructions for the receiver on which the Type REK-140 Range Extension Kit was installed, with reference to removal of protective covers, and the necessary precaution of grounding high voltage circuits before working with the equipment.

5-3. RF CHASSIS ALIGNMENT (Type REK-140 Range Extension Kit).

5-3.1. Second Oscillator, 25 MC.

(1) Using the BC-221-Q frequency meter loosely coupled to the plate circuit, adjust the slug in the oscillator grid coil, L-221, in the Oscillator Tuner, Figure 5-4, for a frequency of 25 MC when the vernier capacity, C-248, is set to zero.

(2) Tune T-203 for maximum voltage with the voltohmyst at test-point TP-208, in the grid circuit of V-208. This should be about 15V.

(3) Since there is some interaction between steps 1 and 2 the frequency should be checked, and steps 1 and 2 repeated as necessary until no further improvement is noted.

5-3.2. Buffer, 25 MC.

(1) Tune T-204 for maximum voltage at the test point, TP-209, in the grid circuit of V-209.

5-3.3. First Mixer Transformers, T-201 and T-202, 30 MC.

(1) Remove the crystal, or the variable frequency tuner.

(2) Remove tube V-201.

(3) Connect the AGC bus at terminal No. 2 to -3 volts from a low impedance source (battery).

(4) Connect the sweep generator, WR59B, and the 30 MC marker generator, 65-B, to pin 1 of tube V-202 using a series .0047 μf capacitor.

(5) Connect the Type 4227 30-MC amplifier input to the SDU OUTPUT jack, P-202. Connect the output terminals of the 30 MC amplifier to the oscilloscope.

(6) Use a 0.66 volt peak-to-peak response on the oscilloscope, and adjust the primary, T-202, and the secondary, T-201, tuning and coupling in T-202 for an over-coupled response with a peak-to-peak bandwidth of 1.3 MC and approximately 22% dip.

(7) Again, using a 0.66 volt peak-to-peak response on the oscilloscope a flat response will be ob-

served with a 3-db bandwidth of 1.5 MC. It is normal to require about 20% additional input.

5-3.4. IF Amplifier, 30 MC; Stages T-206 and T-207.

(1) Turn the IF selector switch to the 500 KC position.

(2) Leave out tube V-201, and ground the AGC at terminal No. 3 on IF chassis.

(3) Connect the sweep generator, WR-59B, and the marker generator, 65-B, to the grid of V-210, pin 1.

(4) Connect the oscilloscope to test point, TP-209, in the grid of the circuit of V-209.

(5) Use a 0.3 V peak-to-peak response on the oscilloscope and adjust the primary of T-207 and the secondary of T-206, tuning for a slightly over-coupled response with a 3-db bandwidth of 1.3 MC.

(6) Retain all settings, and leave out crystal and V-201 for the next test.

5-3.5. Overall 30 MC IF and First Mixer Neutralization.

(1) Preliminary settings remain the same as for previous test.

(2) Connect the sweep generator, WR59B, and the marker generator, 65-B, to pin 1 of tube V-202 with a .0047 μf capacitor in series with the sweep lead.

(3) Leave the oscilloscope connected to the test point, TP-209, in the grid circuit of V-209.

(4) Using a 0.3V peak-to-peak response on the oscilloscope, the overall response should be slightly overcoupled and have a 3-db bandwidth of 1.1 MC. If necessary, touch-up T-206 and T-207.

(5) Remove the filament voltage from pin No. 3 of V-202 at C-246.

(6) Increase input from the sweep generator until a response curve is observed.

(7) Adjust the sleeve of the neutralizing capacitor, C-215, for minimum output on the oscilloscope and cement the sleeve.

(8) Reconnect the filament connection on C-246.

5-3.6. First Oscillator, L-220.

(1) Plug in the 45.0833 MC crystal for 240.5 MC receiver operating frequency.

(2) Attach the VTVM to test-point TP-207 associated with pin 7 of V-206.

(3) Adjust L-220 for maximum voltage (about 2.2 volts).

5-3.7. Amplifier, L-216 and L-217, 133 MC Center Frequency.

(1) Remove the crystal oscillator.

(2) Couple the WR59B sweep generator and the 608D marker generator to pin 1 of V-205. Use the BALUN converter, if needed, and a length of RG55/U cable terminated in 50 ohms.

(3) Connect the oscilloscope to test-point, TP-205, in the grid circuit of V-204.

(4) Tune the primary, L-216, and secondary L-217, for overcoupled response with a peak-to-peak bandwidth of about 25 MC (120-145 MC).

5-3.8. Tripler, L-218 and L-219, 133 Center Frequency.

(1) Remove the crystal oscillator.

(2) Couple the WR59B sweep generator and the 608D marker generator onto pin 7 of V-206. Use BALUN converter and a length of RG55/U terminated in 50 ohms.

(3) Connect the oscilloscope to test-point TP-206 in the grid circuit of V-205.

(4) Tune the primary, L-218, and secondary, L-219, for overcoupled response with a peak-to-peak bandwidth of about 25 MC (120 to 145 MC) approximately 75% dip.

5-3.9 Tripler and Amplifier Tuned Circuits (133 MC).

(1) Remove the crystal oscillator.

(2) Couple the sweep generator, WR59B and marker generator 65-B onto pin 7 of V-206. Use the BALUN converter and a length of RG55/U cable terminated in 50 ohms.

(3) Observed response shall have a 3-db bandwidth of about 25 MC and a 55% dip, (120 to 145 MC.)

5-3.10. Doubler, L-214 and L-215 (Output 267 MC).

(1) Remove the crystal oscillator and tune the inductuner to 215 MC.

(2) Couple the WR59B sweep generator and the 608-D marker generator onto pin 1 of V-204.

(3) Connect the oscilloscope to test-point, TP-204, in the grid circuit of V-203.

(4) Short the plate of V-203 to ground using 1000 uuf ceramic disc capacitor with short leads.

(5) Tune the primary and secondary for overcoupled response with a 3-db bandwidth of about 45 MC (245 to 290 MC) and a dip of approximately 25%.

5-3.11. Tracking RF Section (Refer to Figure 5-2 for Response Curves).

(1) Connect the WR59B sweep generator to the RF input as shown in Figure 5-1. Connect the AGC to the "Z" input on the oscilloscope.

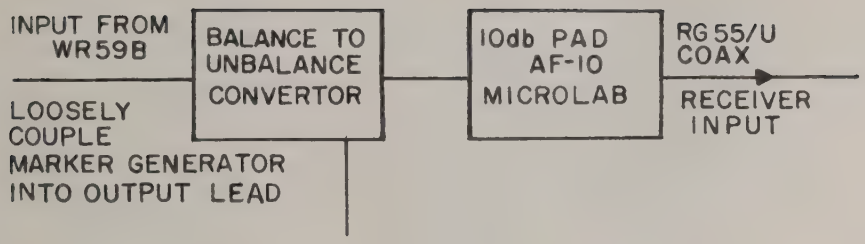


Figure 5-1. Input Connection for RF Alignment.

(2) Connect the oscilloscope and the VTVM to test point, TP-203, in the grid of V-202.

(3) Set the RF dial to 256 MC and plug in the appropriate crystal (47.6666 MC).

(4) Adjust L-213 for maximum voltage as indicated by the VTVM.

(5) Adjust L-205, L-208 and the coupling capacitor, C-208, for a slightly overcoupled response centered at 256 MC, Figure 5-2, E. The 3-db bandwidth should be about 4 MC.

(6) Set the RF dial to 216.5 MC and plug in the appropriate crystal, (41.0833 MC). Check sweep and marker generators accordingly, and check alignment.

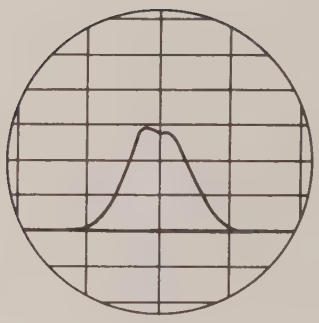
(7) If the response shape at 216.5 MC is distorted, Figure 5-2 A, or tilted more than 20%, go back to 256 MC. Adjust L-205 and L-208 to produce some overtilt in the opposite direction. Then, recheck the 216.5 MC response shape to assure that the tilt or distortion has been eliminated. Some adjustment of coupling capacitor, C-208, may also be necessary for proper bandwidth (approximately 4 MC at 3-db points).

(8) Check the RF response at 224.0 MC, 240.5 MC, 247 MC, and 260 MC, Figure 5-2, B, C, D, and E. The 3-db bandwidth should be constant at approximately 4 MC. The oscillator injection voltage measured at the test-point TP-203, should be about 1.25 to 1.6 volts at all frequencies in the band (1 volt minimum).

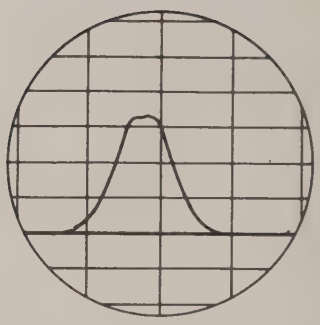
5-4. SECURING THE EQUIPMENT.

1. Replace the REK-140 Chassis cover and tighten securely.

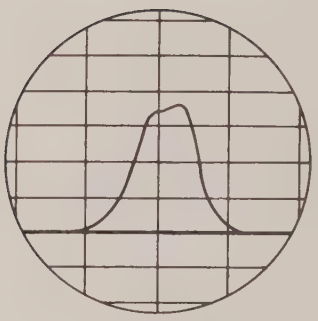
2. Secure the chassis and protective cover of the receiver as outlined in the instructions for the receiver in which the REK-140 was installed.



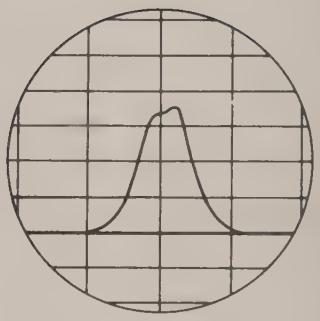
A. 216.5 MC



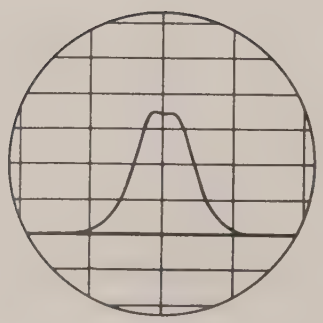
B. 224.0 MC



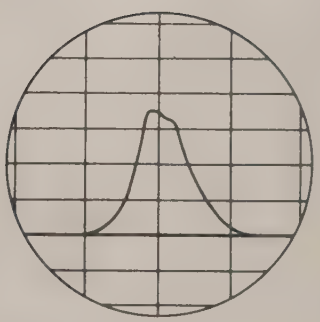
C. 240.5 MC



D. 247.0 MC



E. 256.0 MC



F. 260.0 MC

Figure 5-2. Response Curves, RF.

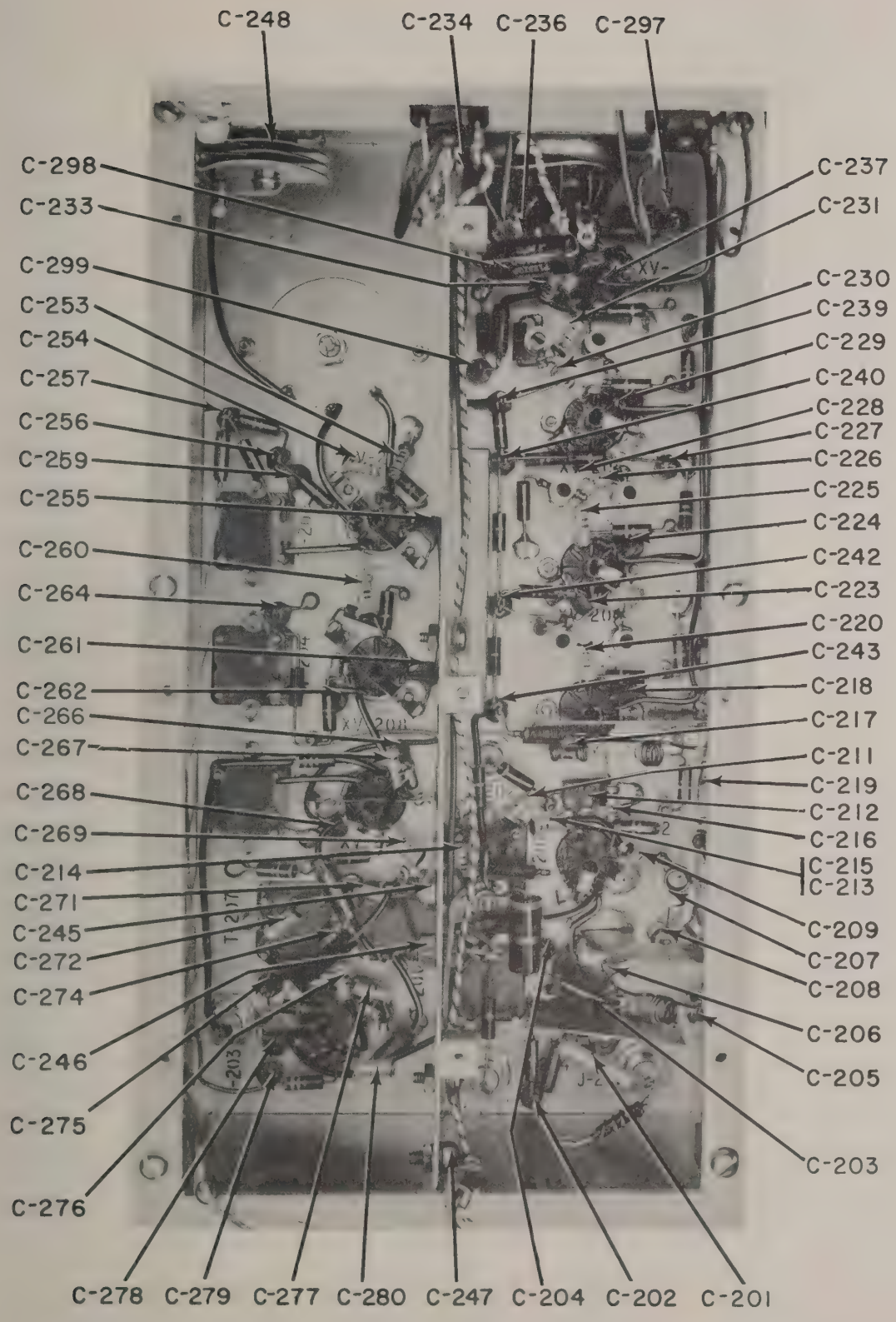


Figure 5-3. Capacitor Location, Type REK-140 Range Extension RF Chassis.

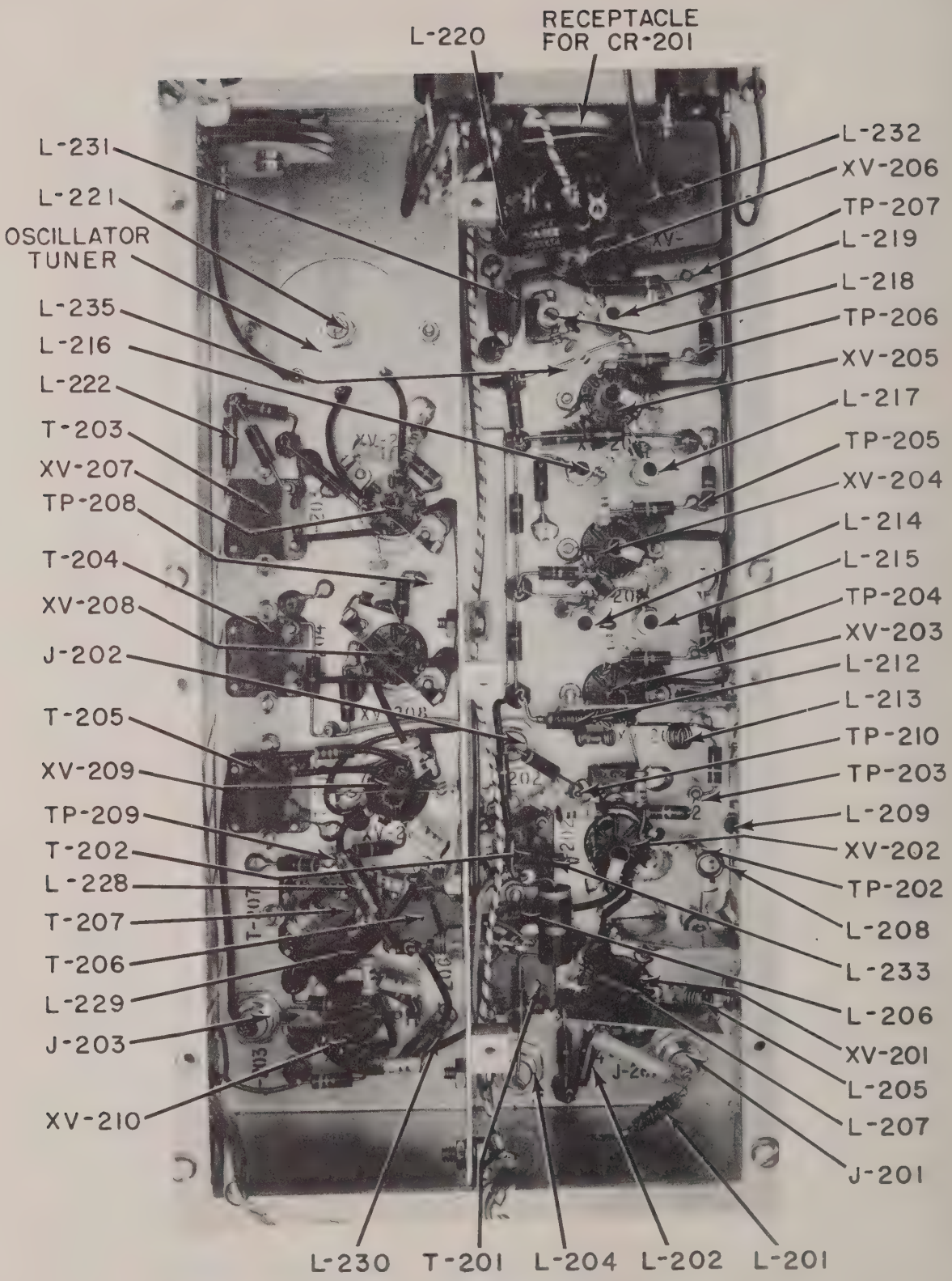


Figure 5-4. Coils, Test-Points, etc., Type REK-140 Range Extension RF Chassis.

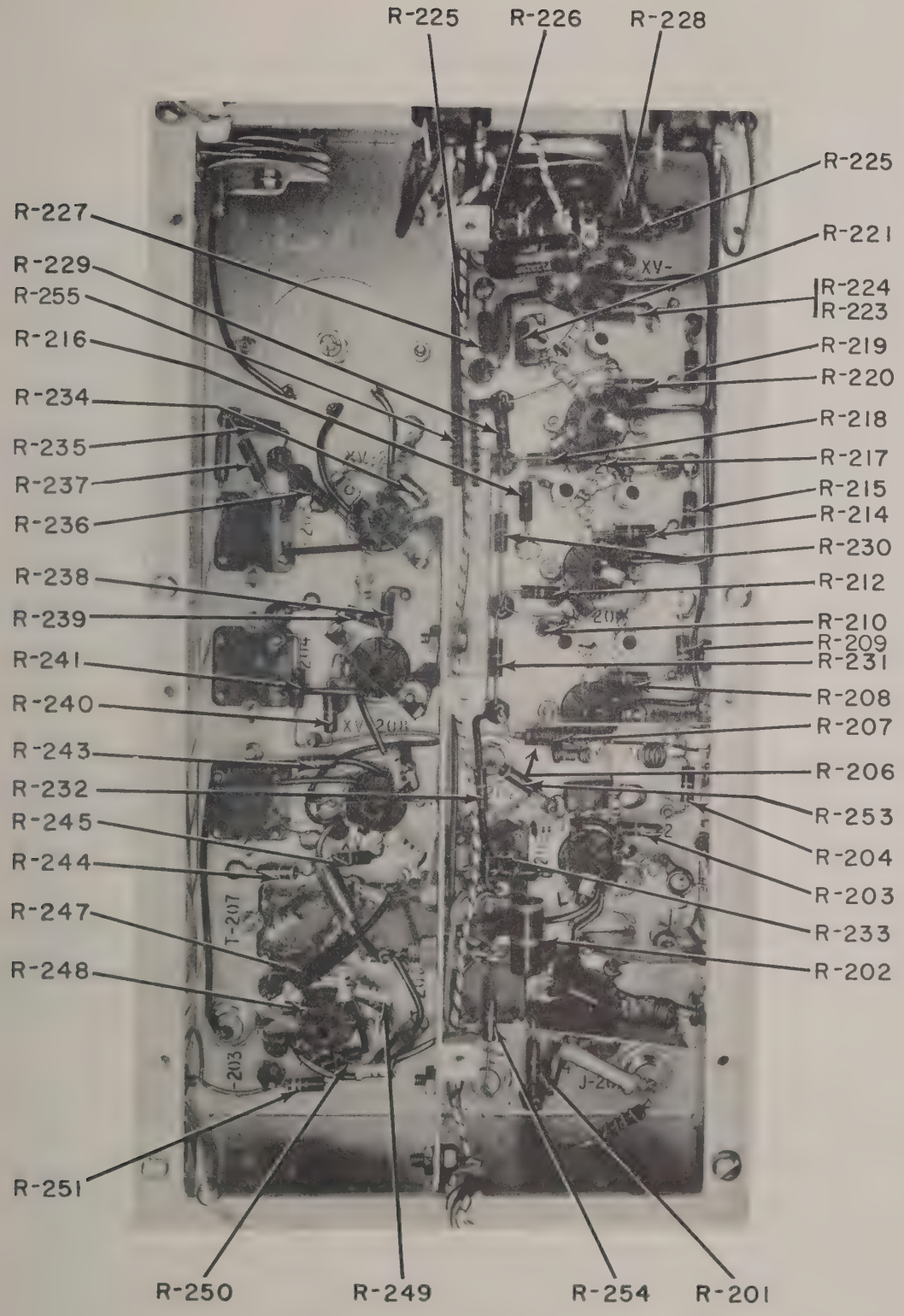


Figure 5-5. Resistor Location, Type REK-140 Range Extension RF Chassis.

SECTION VI

INSTALLATION

6-1. PHYSICAL DESCRIPTION.

6-1.1. Chassis. The chassis body of the REK-140 Range Extension Kit, Figure 1-1, is of sheet aluminum construction, 5x10x2 inches high, on the top panel of which are mounted the electron tubes, IF transformers, oscillator tuner, cable connection jacks, and test-point terminals. The underside houses all other electronic components. A vertical divider through the length of the chassis, Figure 5-4, shields the IF amplifier, mixer, tripler, and first oscillator circuits from the 30 MC IF amplifier, second mixer, and second oscillator circuits. On the front end of the chassis is mounted the shaft for the FREQ. dial and the receptacle for the crystal-and-oven assembly. When mounted, all operating controls are accessible from the front panel of the receiver.

6-1.2. Inductuner Housing. On the right side of the chassis is mounted the inductuner housing measuring approximately 2x2x5-1/2 inches long. Extending from one end, toward the front, is the shaft connecting with the tuning-dial shaft-extension.

6-1.3. Dimensions and Weight. The Type REK-140 Range Extension Kit measures 7 inches wide by 5-1/2 inches high, by 11 inches long overall. The net weight is 2 lbs. 2 ounces; shipping weight is approximately 3 lbs.

6-1.4. Mounting Accessories Supplied. Since it is not always possible to determine in advance the type of knobs used on the receivers to be modified, dial assemblies for both the "VIZ" type and the "Raytheon" type knobs are supplied as a convenience to the user so that a matching assembly can be installed on the receiver. The extra, unused, assembly may be discarded.
Figure 6-1 illustrates the mounting accessories supplied, each complete with necessary set screws, and a detailed installation instruction drawing.

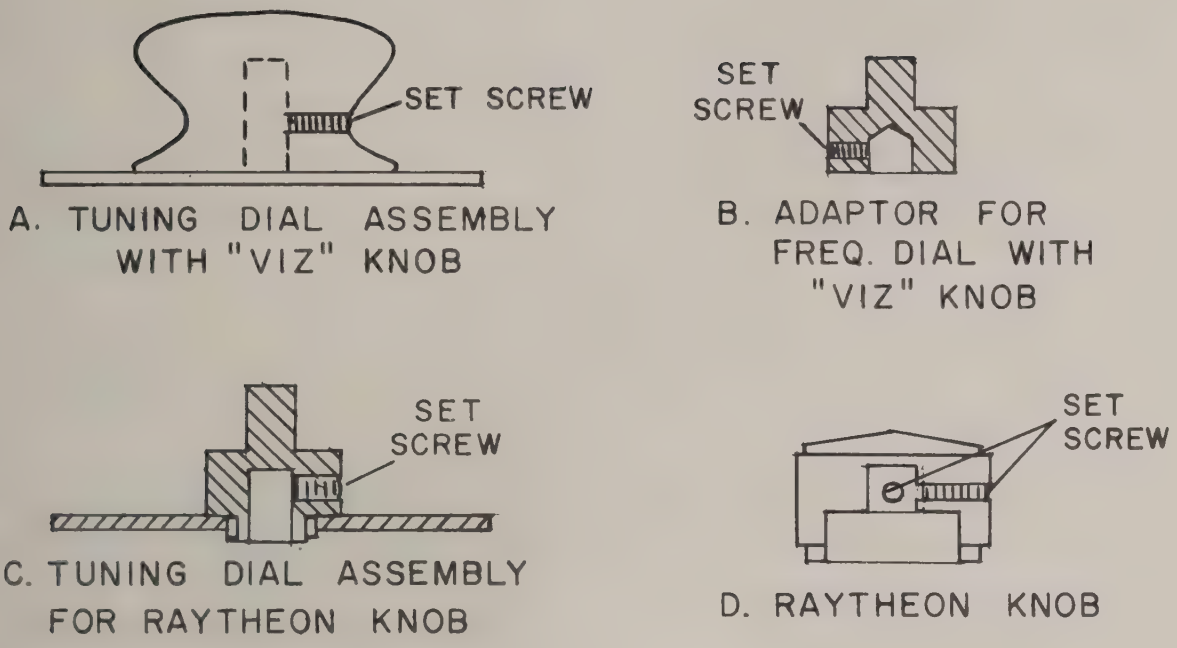

SET SCREW
A. TUNING DIAL ASSEMBLY WITH "VIZ" KNOB
SET SCREW
B. ADAPTOR FOR FREQ. DIAL WITH "VIZ" KNOB
SET SCREW
C. TUNING DIAL ASSEMBLY FOR RAYTHEON KNOB
SET SCREW
D. RAYTHEON KNOB

Figure 6-1. Mounting Accessories Furnished with Type REK-140 Range Extension Kit.

6-2. INSTALLATION.

WARNING

The receiver employs voltages which are dangerous and may be fatal if contacted by operating personnel. Extreme caution should be exercised while working with this equipment.

6-2.1. Tools required.

5/8" round nut wrench
3/8" open end wrench
No. 6 Allen wrench
No. 8 Allen wrench
Screw driver
Soldering Iron

6-2.2. Removal of Existing RF Chassis From Receiver. Disconnect the power supply line at J-101. Remove the bottom dust cover from the main chassis of the receiver, and, with a grounding stick, discharge the high-voltage supply circuits to prevent the possibility of shock while working with this equipment. Remove the RF Chassis as follows:

(1) Remove the POWER toggle switch using the round-nut wrench. (Removal of the switch is necessary to permit access to the nut holding the tuning-dial lock mechanism.)

(2) Remove the lock mechanism of the TUNING dial and of the FREQ. dial by loosening the nut behind the panel with the 3/8" end-wrench.

(3) On receivers having "VIZ" type knobs, loosen the set screws of the TUNING and FREQ. dial knobs and remove the knob-and-dial assembly from the shaft. See Figure 6-1, A.

(4) On receivers having "Raytheon" knobs, loosen the set screws and remove the knobs. Then, loosen the set screws of the shaft adaptor holding each dial on the shaft and remove the dials. See Figure 6-1 D and C.

(5) Loosen the set screw nearest the inductuner in the coupling of the tuning dial shaft-extension, and slip the coupling and shaft extension from the inductuner shaft through the bushing on the front panel. Do not remove the shaft extension.

(6) Remove the RF chassis cover.

(7) Disconnect the wires leading from the RF chassis to the terminals on the main chassis, and the connecting cables from J-201, J-202, J-203, and J-204.

(8) Remove the screws that hold the RF chassis onto the main chassis, while holding the RF chassis on the opposite side to prevent accidental dropping of the unit, and ease out of the main chassis.

6-2.3. Installation of the Type REK-140 Range Extension Modification Kit.

(1) Receivers fitted with "VIZ" type knobs require that the shaft of the FREQ. dial, C-248, on the Range Extension Chassis be cut as shown in Figure 6-2, so that the frequency dial may be remounted at the proper distance from the panel with the shaft-adaptor supplied. No modification is necessary for receivers fitted with "Raytheon" knobs.

(2) Insert the Type REK-140 Range Extension chassis into the space formerly occupied by the chassis just removed, and replace the screws firmly. NOTE: Model 1400 Receivers require removal of the meters and remounting with adaptor rings, supplied on request.

(3) Connect the wires on the underside of the chassis to the terminals on the main chassis according to the matching color code on Models 1400-A, 1401-B and 1411-A, Telemetry Receivers. (NOTE: On Models 1400, 1401, 1401-A, and 1411, the color coded wires on the

Type REK-140 may not match the color codes of the terminals on the main chassis, therefore, it is important that the circuits be traced with the aid of the schematic diagram, Figure 8-1, to insure that the proper connections are made.

(4) Install the TUNING dial assembly, Figure 6-1, A, with matching "VIZ" knob, or Figure 6-1, C for matching "Raytheon" knob, on shaft extension leading to the inductuner, mount the Raytheon knob and tighten the set screws firmly.

(5) Turn the shaft on the inductuner counter-clockwise until it stops and replace the coupling on the extension of the shaft. Turn the dial counterclockwise until the pointer next to the 215 MC calibration is in line with the fixed marker on the panel. Adjust the dial approximately 1/8 inch from the surface of the panel and tighten the set screw on the coupling firmly. If necessary, readjust until the pointer is coincident with the stop point of the inductuner when the dial is turned counterclockwise.

(6) Set the movable blades of the capacitor, C-248, horizontally with respect to the front of the receiver (at 90^{o} with respect to the edge of the fixed blades) in such a manner that the crescent portion of the blades meshes with the fixed blades on clock-wise rotation of the shaft. Replace the FREQ. (+150-0 -150 Kilocycles) dial. See Figure 6-2 for installation of "VIZ" Type Knob, using the shaft adaptor supplied, Figure 6-1, B. No modification is necessary for installation of "Raytheon" knob.

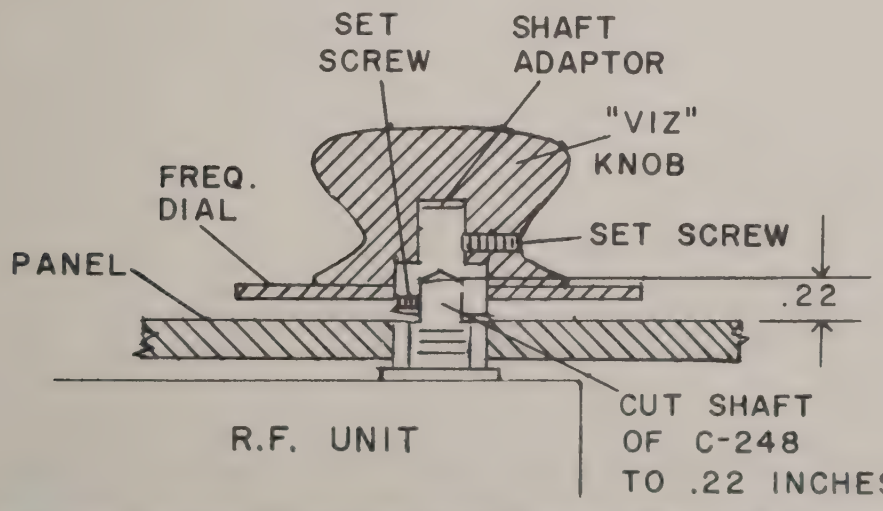


Figure 6-2. Assembly of FREQUENCY Dial for Type REK-140 Range Extension Kit On Receivers Fitted with "VIZ" Type Knobs.

(7) Replace the lock mechanism on both dials and tighten securely.

(8) Replace the POWER toggle switch and tighten securely with the round-nut wrench, and reconnect cables to J-201, J-202, J-203, and J-204.

(9) Before securing the equipment, check operating performance.

6-3. CHECKING OPERATING PERFORMANCE.

6-3.1. Normal Operation. Please refer to paragraphs 3-4 and 4-2 for procedure to determine normal operation. Should the receiver fail to perform as outlined, alignment of the other sections of the receiver may be necessary.

6-3.2. Alignment. Alignment of the Type REK-140 Range Extension Kit is not necessary since the unit has been factory-aligned for optimum operation. However, since the REK-140 has been designed for extended range of receiver operation, it is suggested that the IF and Limiter Discriminator sections of the receiver be carefully checked and realigned before the receiver is placed in operation. Refer to the Maintenance and Alignment procedures in the Instruction Book of the receiver being modified.

SECTION VII

PARTS LIST

Symbol Number	Description and Manufacturer	Other Symbol Numbers Involved
C-201	CAPACITOR, FIXED, MICA: 150 μμf, ±5%, 500V, Elmenco CM15E151J.	
C-202	CAPACITOR, FIXED, CERAMIC: 470 μμf, GMV, 500V, Sprague 507C8A.	
C-203	CAPACITOR, FIXED, CERAMIC: 1000 μμf, MRC, 1000V, Sprague 40C214.	C-205, 218, 219, 223, 224, 228, 229, 237, 255, 259, 261, 262, 264, 266, 268, 278
C-204	CAPACITOR, FIXED, CERAMIC: 1000 μμf, MRC, 500V, Sprague 507C2.	C-227, 234, 239, 240, 242, 243, 247, 256, 257, 275, 279, 297, 299
C-205	Same as C-203.	
C-206	CAPACITOR, FIXED, CERAMIC: 1 μμf, ±.1 μμf, 500V, Erie NPO-A.	C-216
C-207	CAPACITOR, FIXED, CERAMIC: .68 μμf, ±.1 uuf, 500V, Erie NPO-A.	C-215
C-208	CAPACITOR, VARIABLE: 0.5-4.5 μμf, 500V, CTC, CST-6.	
C-209	CAPACITOR, FIXED, CERAMIC: 8.2 μμf, ±.25 μμf, 500V, Erie NPO-A.	
C-210	CAPACITOR, FIXED, CERAMIC: 10 μμf, ±10%, 500V, Erie NPO-A.	C-213, 214, 254, 298
C-211	CAPACITOR, FIXED, CERAMIC: 4.7 μμf, ±.25 μμf, 500V, Erie NPO-A.	
C-212	CAPACITOR, FIXED, MICA: 120 μμf, ±5%, 500V, Elmenco CM15E121J.	
C-213	Same as C-210.	
C-214	Same as C-210.	
C-215	Same as C-207.	
C-216	Same as C-206.	
C-217	CAPACITOR, FIXED, CERAMIC: 15 μμf, ±10%, 500V, Erie NPO-A.	C-270
C-218	Same as C-203.	
C-219	Same as C-203.	
C-220	CAPACITOR, FIXED, CERAMIC: 22 μμf, ±10%, 500V, Erie NPO-A.	C-233, 263
C-221	Same as C-207.	

Symbol Number	Description and Manufacturer	Other Symbol Numbers Involved
C-222	Not used	
C-223	Same as C-203.	
C-224	Same as C-203.	
C-225	CAPACITOR, FIXED, CERAMIC: 470 μμf, ±10%, 500V, Erie GP2-331.	C-230, 274, 276, 277, 280
C-226	CAPACITOR, FIXED, CERAMIC: 1.8 μμf, ±.25 μμf, 500V, Erie NPO-A.	
C-227	Same as C-204.	
C-228	Same as C-203.	
C-229	Same as C-203.	
C-230	Same as C-225.	
C-231	CAPACITOR, FIXED, CERAMIC: 2 μμf, ±.1 μμf, 500V, Erie NPO-A.	
C-232	Not used.	
C-233	Same as C-220.	
C-234	Same as C-204.	
C-235	Not used.	
C-236	CAPACITOR, FIXED, PAPER: 0.1 μf, ±20%, 200V, Aerovex P123ZGP.	
C-237	Same as C-203.	
C-238	Not used.	
C-239	Same as C-204.	
C-240	Same as C-204.	
C-241	Not used.	
C-242	Same as C-204.	
C-243	Same as C-204.	
C-244	Not used.	
C-245	CAPACITOR, FIXED, CERAMIC: 1000 μμf, GMV, 500V, Sprague 514C1.	
C-246	Same as C-245.	
C-247	Same as C-204.	
C-248	CAPACITOR, VARIABLE: 2.8-16 μf, 800V, Hammarlund HFA-15-B, modified per NEMS-CLARKE pt. dwg. no. A-18,618.	

Symbol Number	Description and Manufacturer	Other Symbol Numbers Involved
C-249	CAPACITOR, FIXED, CERAMIC: 200 μμf, ±1%, 600V, Centralab TCZ-200. Part of Z-201, not separately replaceable.	
C-250	CAPACITOR, FIXED, CERAMIC: 180 μμf, ±1%, 600V, Centralab TCZ-180. Part of Z-201, not separately replaceable.	
C-251	Same as C-253. Part of Z-201, not separately replaceable.	
C-252	CAPACITOR, FIXED, CERAMIC: 47 μμf, ±10%, 500V, Erie NPO-T. Part of Z-201, not separately replaceable.	
C-253	CAPACITOR, FIXED, CERAMIC: 10 μμf, ±.25 μμf, 500V, Erie NPO-A.	C-251, 254
C-254	Same as C-253.	
C-255	Same as C-203.	
C-256	Same as C-204.	
C-257	Same as C-204.	
C-258	CAPACITOR, FIXED, CERAMIC: 15 μμf, ±10%, 500V, Type CC20CG150K.	
C-259	Same as C-203.	
C-260	CAPACITOR, FIXED, CERAMIC: 47 μμf, ±10%, 500V, Erie NPO-A.	C-269
C-261	Same as C-203.	
C-262	Same as C-203.	
C-263	Same as C-220; part of T-204, not separately replaceable.	
C-264	Same as C-203.	
C-265	CAPACITOR, FIXED, MICA: 51 μμf, ±5%, 500V, Elmenco CM15E510J. Part of T-205, not separately replaceable.	
C-266	Same as C-203.	
C-267	CAPACITOR, FIXED, CERAMIC: 2.2 μμf, ±.1 μμf, 500V. Erie NPO-A.	C-271, 272
C-268	Same as C-203.	
C-269	Same as C-260.	
C-270	Same as C-217; part of T-206, not separately replaceable.	
C-271	Same as C-267.	
C-272	Same as C-267.	
C-273	CAPACITOR, FIXED, CERAMIC: 3.3 μμf, ±.25 μμf, 500V. Part of T-207, not separately replaceable.	

Symbol Number	Description and Manufacturer	Other Symbol Numbers Involved
C-274	Same as C-225.	
C-275	Same as C-204.	
C-276	Same as C-225.	
C-277	Same as C-225.	
C-278	Same as C-203.	
C-279	Same as C-204.	
C-280	Same as C-225.	
C-281	Not used.	
C-282	CAPACITOR, FIXED, MICA: 240 μμf, ±5%, 500V, Elmenco CM15E241J.	
C-283 thru C-296	Not used.	
C-297	Same as C-204.	
C-298	Same as C-213.	
C-299	Same as C-204.	
CR-201	CRYSTAL-AND-OVEN ASSEMBLY: To be selected depending on frequency requirements. NEMS-CLARKE Type CO-400 (See Table 3-1) or VARIABLE FREQUENCY TUNING UNIT: 215-260 MC, NEMS-CLARKE Type VF-1400.	
J-201 thru J-204	CONNECTOR, RECEPTACLE: Type UG-1094/U.	
L-201	COIL, NEMS-CLARKE part/dwg. no. A-19, 699-1.	
L-202	CHOKE, 0.9 μh. NEMS-CLARKE part/dwg. no. AA-15,496-1.	L-222, 229
L-203	Not used.	
L-204 A, B, C	INDUCTUNER: Modified per NEMS-CLARKE part/dwg. no. B-15,517.	
L-205	COIL: NEMS-CLARKE part/dwg. no. A-19,700-1.	
L-206	CHOKE: 2.75 μh, NEMS-CLARKE part/dwg. no. AA-15,496-2.	L-228, 230
L-207	COIL: NEMS-CLARKE part/dwg. no. A-19,699-2.	
L-208	COIL: NEMS-CLARKE part/dwg. no. A-19,700-2.	
L-209	COIL: NEMS-CLARKE part/dwg. no. A-19,699-3.	

Symbol Number	Description and Manufacturer	Other Symbol Numbers Involved
L-210	COIL WINDING: Per NEMS-CLARKE dwg. C-15,518-16, Part of T-201, not separately replaceable.	
L-211 A, B	COIL WINDING: Per NEMS-CLARKE dwg. C-15,518-14, Part of T-202, not separately replaceable.	
L-212	COIL: Nems-Clarke part/dwg. no. A-19,699-5.	
L-213	COIL: Nems-Clarke part/dwg. no. A-19,700-3.	
L-214	COIL: Nems-Clarke part/dwg. no. A-19,701-6.	
L-215	Same as L-214.	
L-216	COIL: Nems-Clarke part/dwg. no. A-19,701-5.	
L-217	COIL: Nems-Clarke part/dwg. no. A-19,701-4.	
L-218	COIL: Nems-Clarke part/dwg. no. A-19,701-3.	
L-219	COIL: Nems-Clarke part/dwg. no. A-19,701-2.	
L-220	COIL: Nems-Clarke part/dwg. no. A-19,701-1.	
L-221	COIL: Nems-Clarke part/dwg. no. A-15,494; Part of Z-201, not separately replaceable.	
L-222	Same as L-202.	
L-223	COIL: Nems-Clarke part/dwg. no. C-15,518-15; part of T-203, not separately replaceable.	
L-224	Same as L-223; part of T-204, not separately replaceable.	
L-225	COIL: Nems-Clarke part/dwg. no. C-15,518-14; part of T-205, not separately replaceable.	
L-226	COIL: Nems-Clarke part/dwg. no. C-15,518-13; part of T-206, not separately replaceable.	
L-227	COIL: Nems-Clarke part/dwg. no. C-15,518-12; part of T-207, not separately replaceable.	
L-228	Same as L-206.	
L-229	Same as L-202.	
L-230	Same as L-206.	
L-231	CHOKE: Nems-Clarke part/dwg. no. AA-19,087.	
L-232	Same as L-231.	
L-233	COIL: Length of #20 bus wire.	

Symbol Number	Description and Manufacturer	Other Symbol Numbers Involved
L-234	Not used.	
L-235	COIL: Length of #20 bus wire.	
R-201	RESISTOR, FIXED, COMPOSITION: 68 ohms, ±5%, 1/2W, Allen Bradley EB-6805.	
R-202	RESISTOR, FIXED, COMPOSITION: 3000 ohms, ±5%, 2W, Allen Bradley HB-3025.	
R-203	RESISTOR, FIXED, COMPOSITION: 470 ohms, ±5%, 1/2W, Allen Bradley EB-4745.	R-204, 244, 245
R-204	Same as R-203.	
R-205	RESISTOR, FIXED, COMPOSITION: 30,000 ohms, ±5%, 1/2W, Allen Bradley EB-3035.	
R-206	RESISTOR, FIXED, COMPOSITION: 51,000 ohms, ±5%, 1/2W, Allen Bradley EB-5135.	
R-207	RESISTOR, FIXED, COMPOSITION: 47,000 ohms, ±5%, 1W, Allen Bradley GB-4725.	
R-208	RESISTOR, FIXED, COMPOSITION: 220,000 ohms, ±5%, 1/2W, Allen Bradley EB-2245.	R-209, 214, 215, 219, 220
R-209	Same as R-208.	
R-210	RESISTOR, FIXED, COMPOSITION: 620 ohms, ±5%, 1/2W, Allen Bradley EB-2245.	
R-211	Not used.	
R-212	RESISTOR, FIXED, COMPOSITION: 27,000 ohms, ±5%, 1/2W, Allen Bradley EB-2735.	
R-213	Not used.	
R-214	Same as R-208.	
R-215	Same as R-206.	
R-216	RESISTOR, FIXED, COMPOSITION: 15 ohms, ±5%, 1/2W, Allen Bradley EB-1505.	
R-217	RESISTOR, FIXED, COMPOSITION: 1000 ohms, ±5%, 1/2W, Allen Bradley EB-1025.	R-225, 237, 241, 247
R-218	RESISTOR, FIXED, COMPOSITION: 20,000 ohms, ±5%, 1/2W, Allen Bradley EB-2035.	
R-219	Same as R-208.	
R-220	Same as R-208.	

Symbol Number	Description and Manufacturer	Other Symbol Numbers Involved
R-221	RESISTOR, FIXED, COMPOSITION: 820 ohms, ±5%, 1/2W, Allen Bradley EB-8215.	
R-222	Not used.	
R-223	RESISTOR, FIXED, COMPOSITION: 1 Megohm, 10%, 1/2W, Allen Bradley EB-1051.	R-238
R-224	RESISTOR, FIXED, COMPOSITION: 47,000 ohms, ±5%, 1/2W, Allen Bradley EB-4735.	R-233, 234
R-225	Same as R-217.	
R-226	RESISTOR, FIXED, COMPOSITION: 1200 ohms, ±5%, 1/2W, Allen Bradley EB-1225.	
R-227	RESISTOR, FIXED, COMPOSITION: 270 ohms, ±5%, 1/2W, Allen Bradley EB-2715.	
R-228	Same as R-227.	
R-229	RESISTOR, FIXED, COMPOSITION: 100 ohms, ±5%, 1/2W, Allen Bradley EB-1015.	R-250, 230, 231, 232
R-233	Same as R-224.	
R-234	Same as R-224.	
R-235	RESISTOR, FIXED, COMPOSITION: 10,000 ohms, ±5%, 1/2W, Allen Bradley EB-1035.	R-239, 249
R-236	RESISTOR, FIXED, COMPOSITION: 18 ohms, ±5%, 1/2W, Allen Bradley EB-1805.	
R-237	Same as R-217.	
R-238	Same as R-223.	
R-239	Same as R-235.	
R-240	RESISTOR, FIXED, COMPOSITION: 22,000 ohms, ±5%, 1/2W, Allen Bradley EB-2235.	R-248
R-241	Same as R-217.	
R-242	RESISTOR, FIXED, COMPOSITION: 4200 ohms, ±5%, 1/2W, Allen Bradley EB-4725.	
R-243	RESISTOR, FIXED, COMPOSITION: 33,000 ohms, ±5%, 1/2W, Allen Bradley EB-3335.	
R-244	Same as R-203.	
R-245	Same as R-203.	

Symbol Number	Description and Manufacturer	Other Symbol Numbers Involved
R-246	RESISTOR, FIXED, COMPOSITION: 7500 ohms, ±5%, 1/2W, Allen Bradley EB-7525.	
R-247	Same as R-217.	
R-248	Same as R-240.	
R-249	Same as R-235.	
R-250	Same as R-229.	
R-251	RESISTOR, FIXED, COMPOSITION: 390,000 ohms, ±5%, 1/2W, Allen Bradley EB-3945.	
R-252	Not used.	
R-253	RESISTOR, FIXED, COMPOSITION: 47 ohms, ±5%, 1/2W, Allen Bradley EB-4705.	
R-254	RESISTOR, FIXED, COMPOSITION: 82 ohms, ±5%, 1/2W, Allen Bradley EB-8205.	
R-255	RESISTOR, FIXED, WIREWOUND: 7500 ohms, ±3%, 10W, Dalohm RH-10.	
T-201	TRANSFORMER, IF: Nems-Clarke part/dwg. no. AB-15,533.	
T-202	TRANSFORMER, IF: Nems-Clarke part/dwg. no. AB-15,532.	
T-203	TRANSFORMER, IF: Nems-Clarke part/dwg. no. AB-15,540.	
T-204	TRANSFORMER, IF: Nems-Clarke part/dwg. no. AB-15,493.	
T-205	TRANSFORMER, IF: Nems-Clarke part/dwg. no. AB-15,525.	
T-206	TRANSFORMER, IF: Nems-Clarke part/dwg. no. AB-15,524.	
T-207	TRANSFORMER, IF: Nems-Clarke part/dwg. no. AB-15,539.	
TP-201	Not used.	
TP-202	TEST-POINT, STANDOFF: Sealectro HST-SM-1.	TP-210
TP-203 to TP-209	TEST-POINT, STANDOFF: Sealectro SKT-5BC.	TP-204, 205, 206, 207, 208, 209
TP-210	Same as TP-202.	
V-201	TUBE, ELECTRON: 5848/417A.	
V-202 to V-205	TUBE, ELECTRON: 6AK5W.	V-203, 204, 205

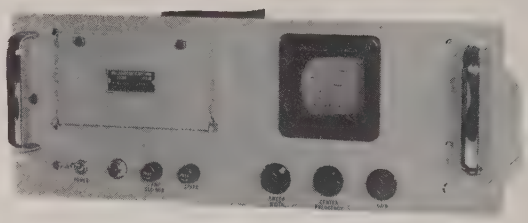
Symbol Number	Description and Manufacturer	Other Symbol Numbers Involved
V-206	TUBE, ELECTRON: 6BZ7.	
V-207	TUBE, ELECTRON: 6AU6.	V-208, 209
V-208	Same as V-207.	
V-209	Same as V-207.	
V-210	TUBE, ELECTRON: 5749/6BA6W.	
XV-201	SOCKET, TUBE: 9 pin. Mycalex 90A299.	
XV-202 to XV-205	SOCKET, TUBE: 7 pin, miniature. Elco BR-151-BC.	XV-203, 204, 205, 207, 208, 209, 210
XV-206	SOCKET, TUBE: 9 pin, miniature, Elco BR-283-BC.	
XV-207 to XV-210	Same as XV-202.	
Z-201	COIL ASSEMBLY, OSCILLATOR TUNER: Nems-Clarke part/dwg.no. AB-16,509.	

ACCESSORIES FOR CRYSTAL-CONTROLLED TELEMETRY RECEIVERS

Accessory	Nems-Clarke No.
Spectrum Display Unit	Type 200-3
Dual Diversity Unit	Type DDU-1000
Crystal-and-Oven Assemblies (Specify Frequency)	Type CO-400
Crystal Oven Energizer	Type COE-150
Variable Frequency Tuning Unit, 215 to 260 MC	Type VF-1400
Phase-Lock Modification Kit	Type PLK-100

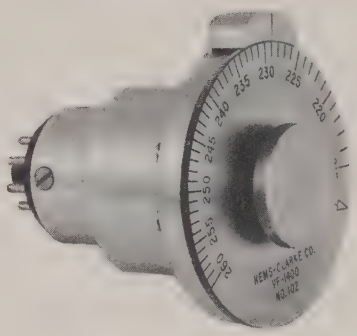
ACCESSORIES FOR CRYSTAL-CONTROLLED
TELEMETRY RECEIVERS

DDU-1000 Dual Diversity Unit

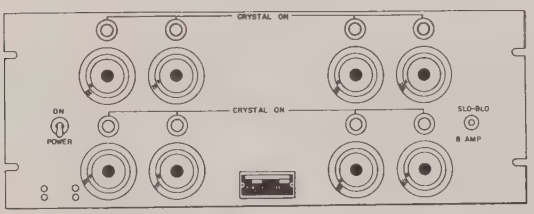


Type 200-3 SDU. Spectrum Display Unit

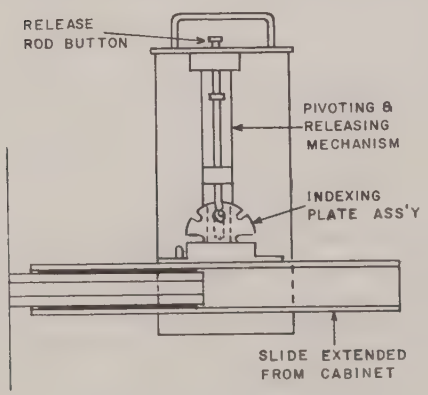
Type CO-400 Crystal and Oven Assemblies
(Specify exact frequency desired)



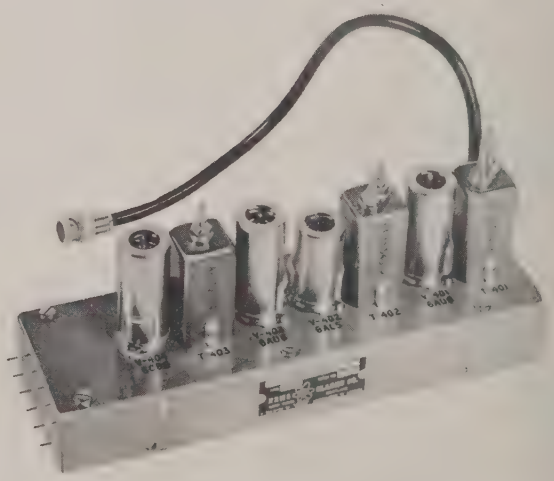
VF-1400 Variable Frequency Tuning Unit
Continuously variable to cover
Receiver Frequencies from 216 to 260 MC



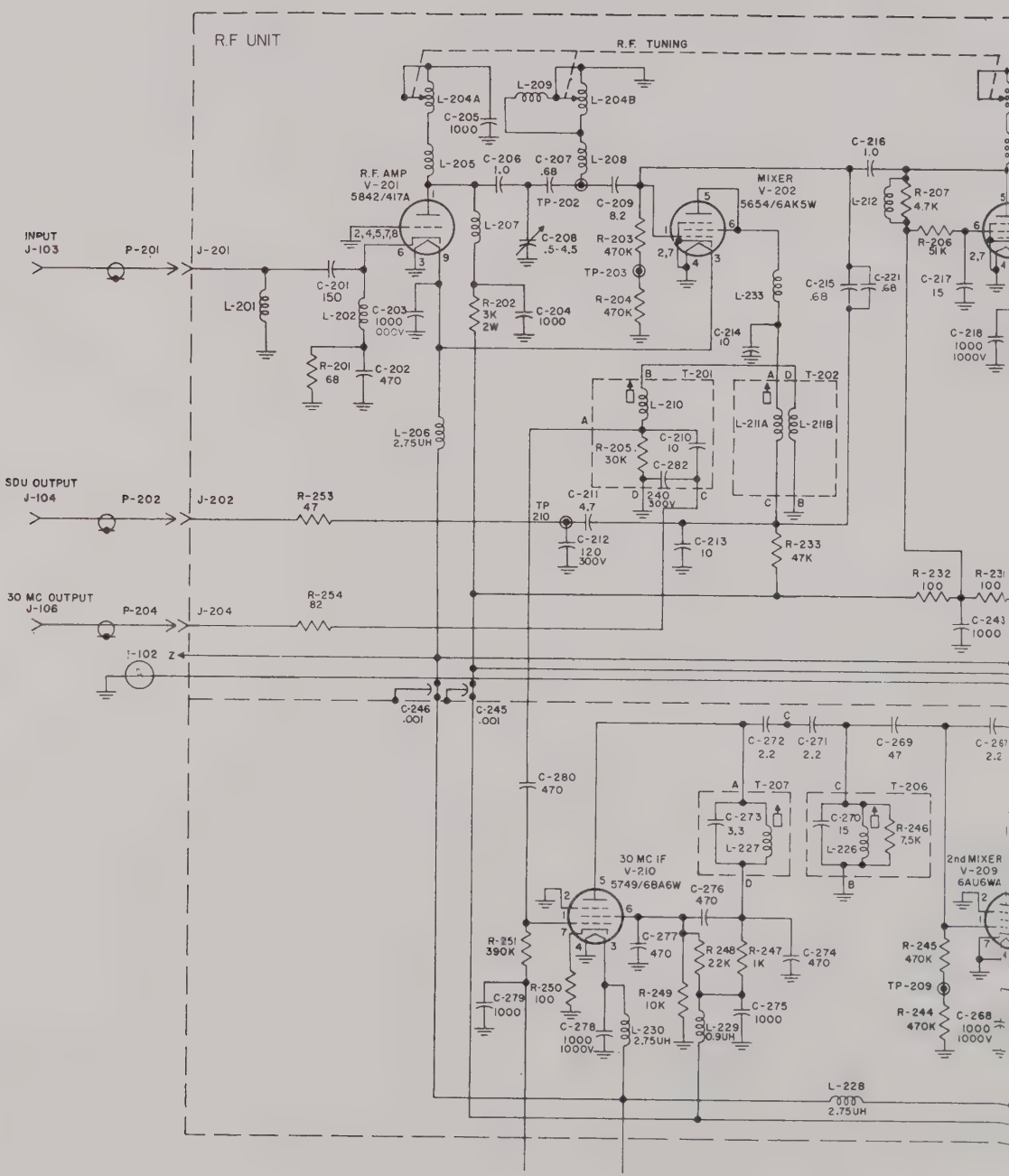
Type COE-150 Crystal Oven Energizer



Type SMT-100 Slide Mounting



Type PLK-100 Phase-Lock Modification Kit


R.F. UNIT
R.F. TUNING
INPUT
J-103
P-201
J-201
L-201
C-201
150
L-202
C-203
1000
000V
R-201
68
C-202
470
L-204A
C-205
1000
L-205
C-206
1.0
C-207
.68
L-208
L-209
L-204B
R.F. AMP
V-201
5842/417A
2,4,5,7,8
6
3
9
L-207
TP-202
C-208
.5-4.5
C-209
8.2
R-202
3K
2W
C-204
1000
R-203
470K
TP-203
R-204
470K
MIXER
V-202
5654/6AK5W
5
6
1
2,7
4
3
L-233
C-214
10
L-206
2.75UH
T-201
B
A
L-210
R-205
30K
C-210
10
C-282
D
240
300V
C
T-202
A
D
L-211A
L-211B
C
B
C-211
4.7
TP
210
C-212
120
300V
C-213
10
R-233
47K
C-216
1.0
L-212
R-207
4.7K
R-206
51K
C-215
.68
C-221
.68
C-217
15
C-218
1000
1000V
SDU OUTPUT
J-104
P-202
J-202
R-253
47
30 MC OUTPUT
J-106
P-204
J-204
R-254
82
J-102
Z
C-246
.001
C-245
.001
R-232
100
R-231
100
C-243
1000
C-280
470
C-272
2.2
C-271
2.2
C-269
47
C-267
2.2
T-207
C-273
3.3
L-227
T-206
C-270
15
L-226
R-246
7.5K
30 MC IF
V-210
5749/6BA6W
5
2
6
7
4
3
C-276
470
C-277
470
R-251
390K
R-250
100
C-279
1000
C-278
1000
1000V
L-230
2.75UH
R-248
22K
R-247
1K
C-274
470
R-249
10K
L-229
0.9UH
C-275
1000
2nd MIXER
V-209
6AU6WA
R-245
470K
TP-209
R-244
470K
C-268
1000
1000V
L-228
2.75UH

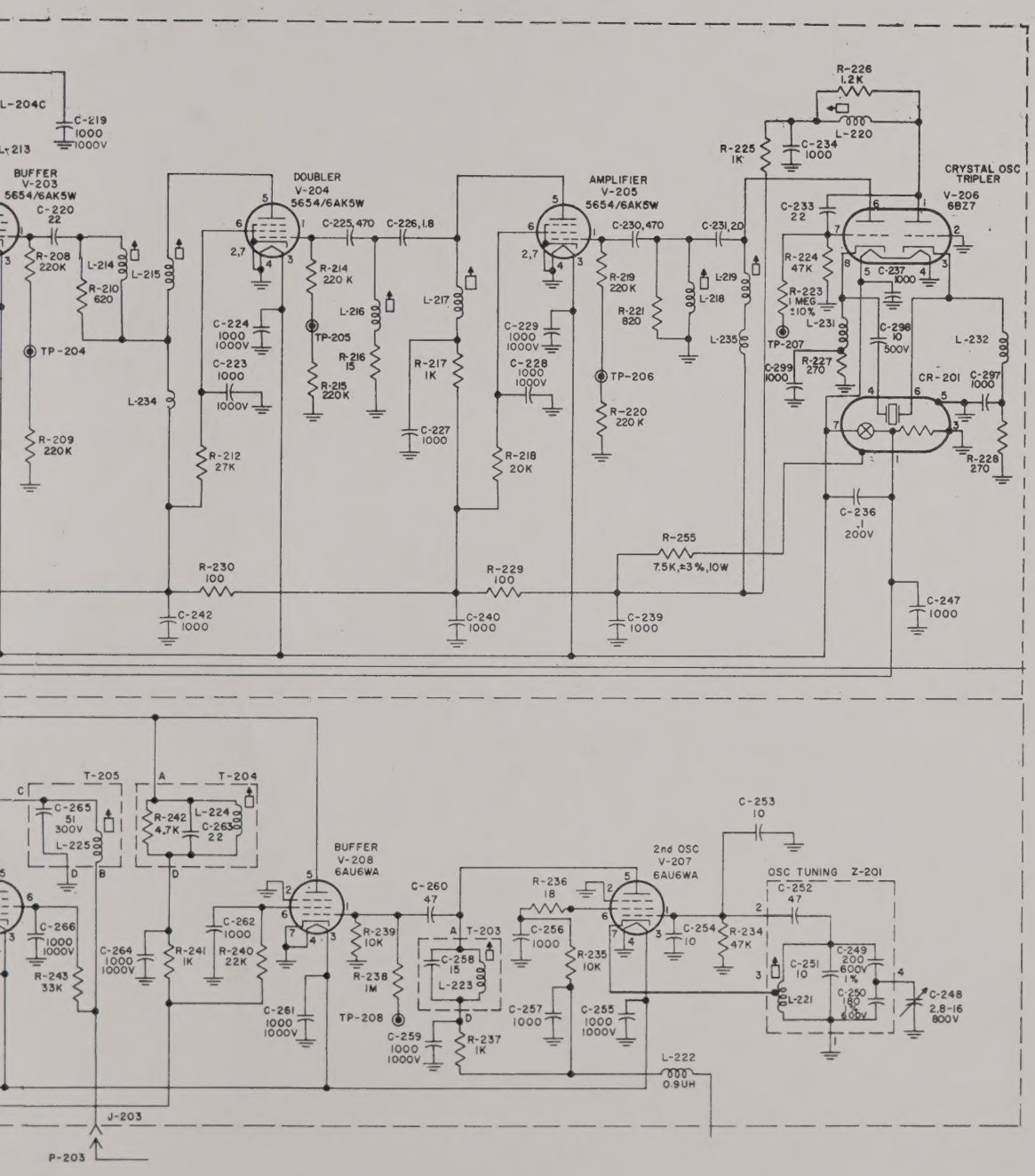
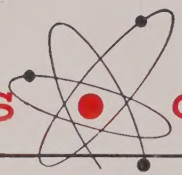


Figure 8-1. Schematic Diagram
Type REK-140 Range Extension RF



NEMS CLARKE CO.

919 JESUP BLAIR DRIVE • SILVER SPRING, MARYLAND

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